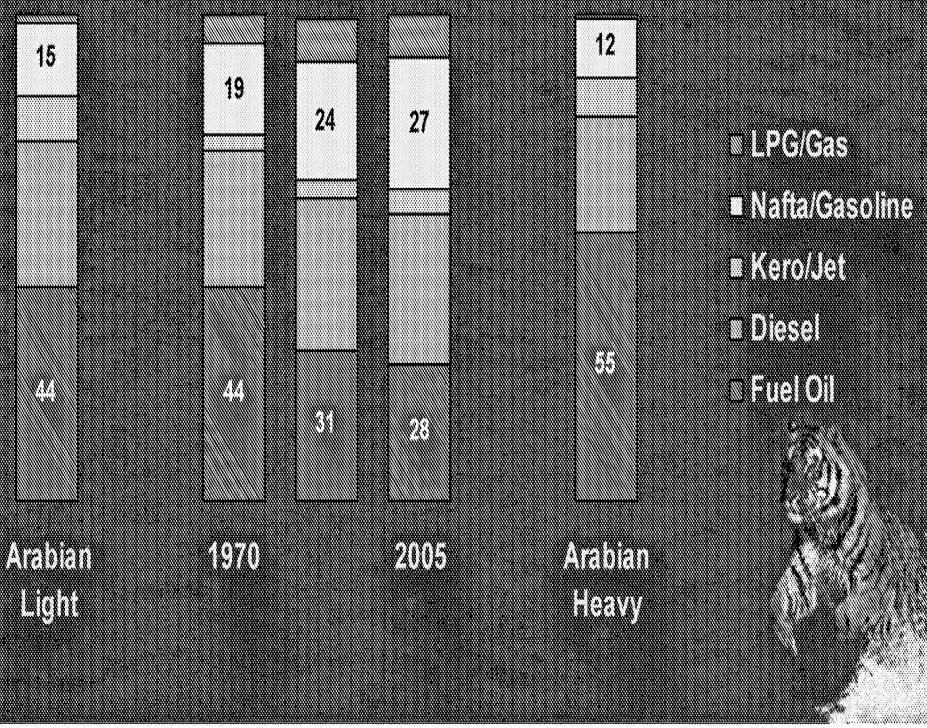
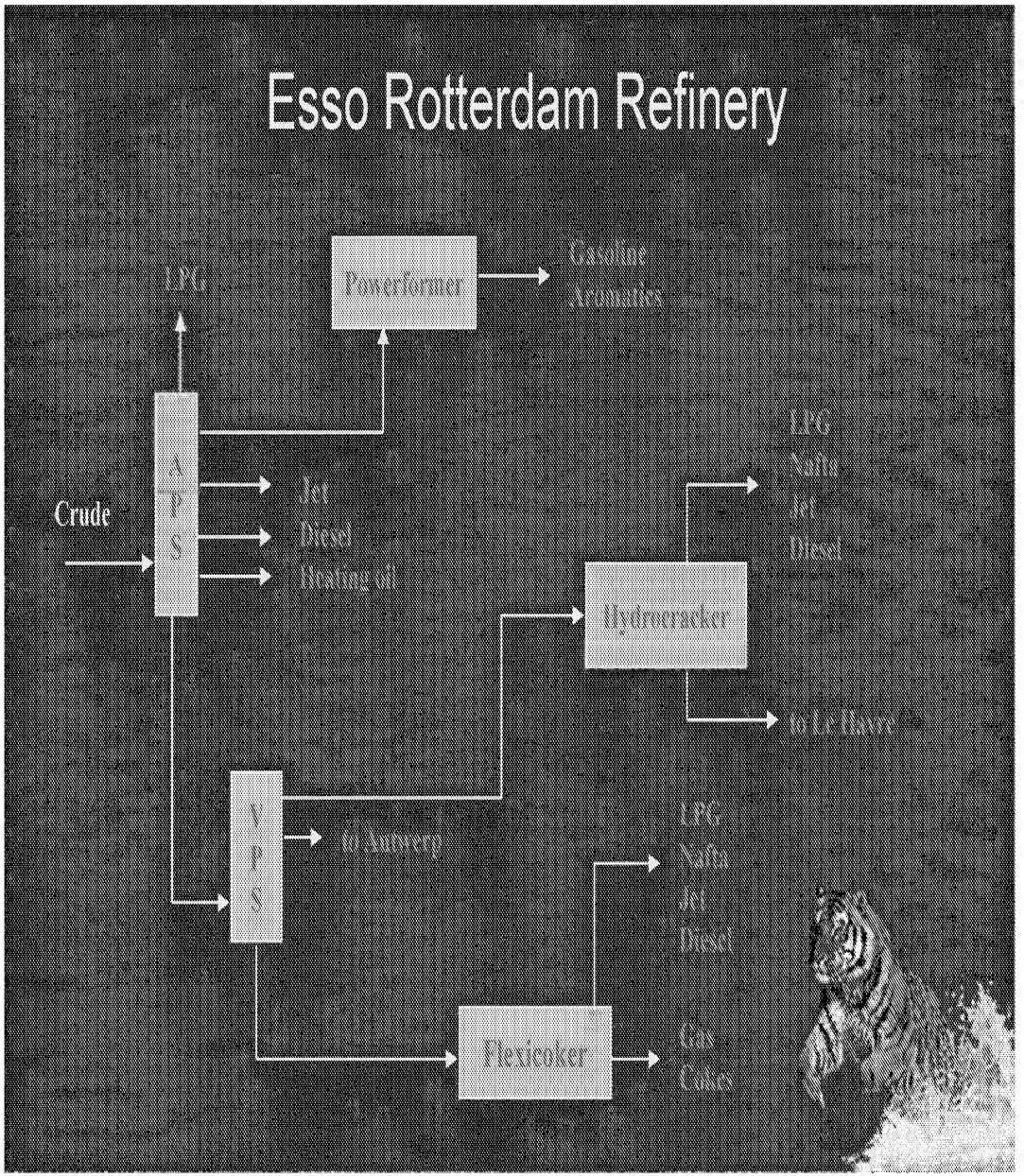
Market demand and crude oil supply



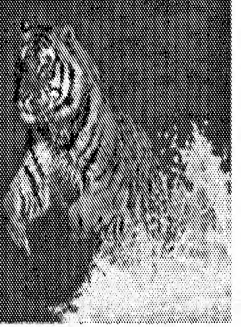
Esso Rotterdam Refinery



Vacuum Residue Conversion Processes

Considerations:

- Market demands for light products
- Environmental legislation for cleaner products
- Stricter regulations on refinery emissions
- Vacuum residue contains a lot of carbon and little hydrogen but also 3-5% sulphur, nitrogen and metals like vanadium and nickel

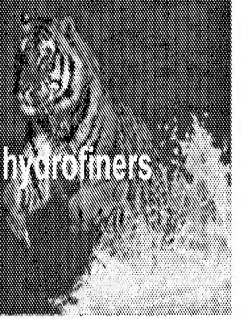


Vacuum Residue Conversion Processes

Two routes for vacuum residue conversion :

- Hydrogen addition processes : Residfining, Hycon
  - high temperature, high hydrogen pressure
  - rapid catalyst deactivation requires large reactors or moving catalyst
  - sensitive for metal contaminants
  - products do not need any further treating

- Carbon rejection by thermal cracking : Delayed Coking, FLUID and FLEXICOKING
  - high temperature, low pressure, no hydrogen
  - no catalyst, abundant coke
  - insensitive to contaminants
  - low refinery SO2 emissions
  - products need after treatment in conventional hydrofiners



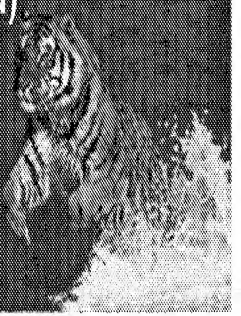
Flexicokers

All build 1980 - 1990, investment > 1 billion $$

Rotterdam	NL	ExxonMobil
Baytown	USA-Tx	ExxonMobil
Martinez	USA-Ca	Shell
TOA	Japan	State-owned
Amuay	Venezuela	State-owned

Why only 5 Flexicokers in the world ?

- Initial investment
- Mechanical cost (mainly in Turnaround)
- Runlength



SIMPLIFIED FLEXICOKER PROCESS